

1 WHAT IS CLAIMED IS:

1 1. A method for writing servo tracks on a rotating magnetic disk medium,  
2 comprising:

3 following a reference track comprising previously-written servo patterns;

4 using a servo control loop while writing servo patterns at a first target  
5 track on the magnetic disk medium, the servo control loop having a closed-loop  
6 response and including a two-dimensional state compensator comprising at least  
7 first and second inputs and first and second outputs, said first input configured to  
8 receive timing error signals, said first output comprising control signals for a  
9 controlled oscillator, said second output comprising first timing state variables  
10 corresponding to said first target track, said second input configured to receive  
11 timing state variables corresponding to said reference track;

12 storing said timing state variables corresponding to said first target track as  
13 first stored timing state variables; and

14 following said first target track using the servo control loop while writing  
15 servo patterns defining a second target track while providing said first stored  
16 timing state variables to said second input of said two-dimensional state  
17 compensator.

1 2. A method for writing servo tracks on a rotating magnetic disk medium,  
2 comprising:

3 writing a reference track comprising servo patterns;

4 track-following said reference track while writing a first self-written servo  
5 track under control of a closed-loop timing servo control loop having a  
6 compensator comprising at least first and second inputs and first and second  
7 outputs, said first input configured to receive timing error signals, said first output  
8 comprising control signals for a controlled oscillator, said second output  
9 comprising first timing state variables corresponding to said first self-written

10 servo track, said second input configured to receive timing state variables  
11 corresponding to said reference track;  
12 storing said first timing state variables; and  
13 track-following said first self-written servo track while writing a second  
14 self-written servo track and while providing said first stored timing state variables  
15 to said second input.

1 3. The method of Claim 2, wherein said control signals for a controlled  
2 oscillator comprise control signals for a voltage-controlled oscillator.

1 4. The method of Claim 2, wherein said control signals for a controlled  
2 oscillator comprise control signals for a numerically-controlled oscillator.

1 5. The method of Claim 2, wherein said compensator comprises an observer-  
2 based compensator.

1 6. An apparatus for writing servo tracks on a rotating magnetic disk medium,  
2 comprising:

3 a rotating magnetic disk medium having a first servo track;  
4 a memory for storing timing state information; and  
5 a timing control system module configured to control timing while self-  
6 writing a second servo track, said control system module comprising a  
7 compensator module, said compensator module comprising:

8 a first input configured to receive timing error signals;  
9 a first output to provide control signals to a controlled oscillator;  
10 a second input configured to receive previously-stored timing state  
11 variables corresponding to said first servo track; and  
12 a second output configured to provide timing state variables  
13 corresponding to said second servo track to said memory.

1 7. The apparatus of Claim 6, wherein said control signals for a controlled  
2 oscillator comprise control signals for a voltage-controlled oscillator.

1 8. The apparatus of Claim 6, wherein said control signals for a controlled  
2 oscillator comprise control signals for a numerically-controlled oscillator.

1           9.     The apparatus of Claim 6, wherein said control signals for a controlled  
2 oscillator comprise control signals for a current-controlled oscillator.

1           10.    The apparatus of Claim 6, wherein said control signals for a controlled  
2 oscillator comprise control signals for a phase-controlled oscillator.

1           11.    The apparatus of Claim 6, wherein said second servo track comprises  
2 servo burst patterns.

1           12.    The apparatus of Claim 6, wherein said second servo track comprises  
2 spiral servo patterns.

1           13.    The apparatus of Claim 6, wherein said second servo track comprises  
2 repetitive patterns whose amplitude varies with position.

1           14.    The apparatus of Claim 6, wherein said second servo track comprises  
2 repetitive patterns whose phase varies with position.

1           15.    An apparatus for writing servo tracks on a rotating magnetic disk medium,  
2 comprising:

3                 means for track-following said reference track while writing a self-written  
4 servo track under control of a closed-loop timing servo control loop having a  
5 compensator comprising at least first and second inputs and first and second  
6 outputs, said first input configured to receive timing error signals, said first output  
7 comprising control signals for a controlled oscillator, said second output  
8 comprising first timing state variables corresponding to said self-written servo  
9 track, said second input configured to receive timing state variables corresponding  
10 to a reference track; and

11                means for storing said first timing state variables.

1           16.    A method for writing servo tracks on a rotating magnetic disk medium,  
2 comprising:

3                 writing a first servo track;

4                 writing a second servo track; and

5                 track-following between said first and second servo tracks while writing a  
6 third servo track under control of a closed-loop timing servo control loop having a

7 compensator comprising at least first and second inputs and first and second  
8 outputs, said first input configured to receive timing error signals, said first output  
9 comprising control signals for a controlled oscillator, said second output  
10 comprising output timing state variables corresponding to said third servo track,  
11 said second input configured to receive timing state variables corresponding to a  
12 combination of stored output timing state variables corresponding to said first  
13 servo track and said second servo track;

1 17. The method of Claim 16, wherein said combination comprises a linear  
2 combination.

1 18. The apparatus of Claim 16, wherein said control signals for a controlled  
2 oscillator comprise at least one of control signals for a voltage-controlled oscillator,  
3 control signals for a numerically-controlled oscillator, control signals for a current-  
4 controlled oscillator, and control signals for a phase-controlled oscillator.

1 19. The apparatus of Claim 16, wherein said second servo track comprises  
2 servo burst patterns.

1 20. The apparatus of Claim 16, wherein said second servo track comprises  
2 spiral servo patterns.

1 21. The apparatus of Claim 16, wherein said second servo track comprises  
2 repetitive patterns whose amplitude varies with position.

1 22. The apparatus of Claim 16, wherein said second servo track comprises  
2 repetitive patterns whose phase varies with position.